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ABSTRACT

Using a product called the synchro-pulse welder as a case study example, this paper discusses the activities of CSIRO (Commonwealth Scientific and Industrial Research Organisation) in identifying and marketing new high-technology products. A general discussion of CSIRO's market research plans includes two goals to be attained within the next 5 years--concentration on fewer but larger programs, and the development of more systematic methods for evaluating projects. A detailed description and analysis of the welding machine includes its initial inception, its advantages, and how its integration into the metal fabrication industry has contributed to the efficiency and competitiveness of other manufacturing products, e.g., a high-speed vision processor for robot systems, a software system for car manufacturers, a unit that checks the conditions of railway lines at high speed, a more efficient process for making structural quality timber from small logs, and a method for measuring the ash content of coal. Two important preconditions for the identification and exploitation of CSIRO's market opportunities for high-technology products are discussed in detail--a high level of communication between marketing experts and scientific experts, and strong and continuing interaction between industry and CSIRO. The paper concludes with a description of the roles of industry (Welding Industries of Australia) and CSIRO's commercial agent (Sirotech Ltd.) in the identification and researching of market opportunities for the synchro-pulse welder, which is used as an example of the importance of carrying out scientific research and market research in tandem to ensure the technology transfer that will enable Australia to compete in world markets. (DJR)

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'IDENTIFYING AND RESEARCHING MARKET OPPORTUNITIES FOR NEW HIGH TECHNOLOGY PRODUCTS'

ADDRESS BY MR PETER DUNSTAN,
DIRECTOR, INFORMATION AND PUBLIC COMMUNICATION, CSIRO

TO

INDUSTRIAL MARKETING RESEARCH GROUP,
MARKET RESEARCH SOCIETY OF AUSTRALIA

MASONIC CENTRE, SYDNEY
6.30 PM, 13 MAY 1986

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

'Market Research' in its broadest sense: evaluation

I wish this evening to bring CSIRO's activities in the identification and marketing of new high-technology products into focus by making a detailed analysis of one particular CSIRO-developed product that is now selling very well on export markets in the US, UK and New Zeland and making a tidy profit for its Australian manufacturers.

Before I do so, however, I would first like to make some mention of market research in its broadest sense, and by that I mean not market research for individual products, but plans that we have to research our own 'market', i.e. the users of our research, so that we are better able to concentrate our research effort in those areas where Australia can most benefit and compete.

This new effort to find out more about our users is an important element in our blueprint for future development. Like any large organisation, CSIRO works to a strategy and we are currently implementing our strategy for five-year period 1985-1990, as set out in a widely-publicised strategy document issued in September last year.

The strategy drew up five main goals to be attained during the five years, but for our purposes tonight I will only mention two of them:

> * First, concentration: CSIRO has decided to concentrate its efforts into fewer but larger programs: we will be trying to distill out the very best of our research programs and give them our fullest support.
>
> There are pressures on CSIRO to be all things to all people, but, with increased with international competition, we must sometimes reject even very good programs in order to give the full support needed to bring the best programs to commercal fruition.
>
> * This of course means that some tough decisions need to be made, and that leads naturally to the second strategy goal I will discuss, evaluation. Choosing the best programs is in itself a complex task, and CSIRO is determined to develop more systematic methods for evaluating projects.
>
> It is a move that was welcomed by our Minister, Mr Jones, when he tabled our Annual Report in Parliament in March this year.
>
> Mr Jones said that, apart from giving CSIRO a better basis for its decisions, more systematic methods of

> evaluation would help the Organization to demonstrate the worth of its research to the nation.
>
> But he pointed out that placing an economic value on scientific discovery is enormously difficult. illustrating this by asking how anyone could attempt to calculate the returns that flowed from Charles Goodyear's discovery of the vulcanisation of rubber 147 years ago. This, he said, had been a largely accidental discovery, and obviously at the time no-one could have foretold its revolutionary effects nor could anyone today put an accurate figure on the returns from it.

The Minister's example well illustrates the problems that face CSIRO or anyone else who attempts to evaluate research. However, we do not see these difficulties as a reason to avoid 'biting the bullet': to succeed in today's business environment and in the even more competitive environment of the 1990s, we will need more rigorous methods than the 'seat of the pants' methods often employed to date.

To implement the strategy goal of systematic evaluation, CSIRO last year appointed an eight-member committee, chaired by Professor Adrienne Clarke of Melbourne University, one of Australia's foremost authorities in the field of biotechnology and a member of the CSIRO Executive.

That committee had its first meeting in December, and is due to submit a final report to the CSIRO Executive before the end of this year. The report will draw up a set of mechanisms and procedures that can be used by the Chiefs of our 41 Divisions and by the Directors of the five Insitutes into which those Divisions are organised.

The committee is now drawing on experience and techniques from within the Organization and externally. For the internal component, a selection of 'best practice' models in a small number of Divisions is being examined in detail. The sample covers the whole spectrum of our research, including agricultural production, mineral exploration and extraction, manufacturing, and environmental monitoring.

The part of the committee's work drawing on external expertise is concerned with the evaluation of potential commercial returns from specific new product developments. A firm of consultants will be commissioned to do a case study of the subject of material science.

The three types of evaluation specified in CSIRO's strategy document are:

. Prospective: for research planning, when the decision is being made whether to begin work in particular areas:

. Periodic: evaluation for management, at regular intervals during the course of research: and

. Retrospective: evaluation following the completion of research and adoption of results.

The committee considers that techniques for evaluation before and during a project are much better-developed than techniques for retrospective evaluation. The ideal situation, as I shall point out in an example soon, is where a company can be involved early on in a project by way of committing a significant amount of funds, and where there is evidence that the company has undertaken a thorough market analysis before committing its resources to the work. In many instances, however, CSIRO will need to take the work to a more advanced stage before companies can be persuaded to make such an investment, and in these cases CSIRO, or its commercial agent, Sirotech Ltd, will need to commission a commercial evaluation.

In the long term, retrospective evaluation should provide a realistic check on the earlier assessments. It may also provide valuable information for other prospective assessments and for demonstrating the worth of research to the nation.

The committee is considering the commissioning of a case study of a set of programs that were under way ten years ago, possibly in the chemical industry, which would survey the extent of utilisation of the results of that research and the resultant economic benefits today.

The Synchro-Pulse Welder: a case study

As I said at the beginning of my address, I want to approach the subject of identifying and researching particular high-technology products by way of an example of a product that is now doing well on the export market.

The product I have selected is in the area of manufacturing. It has sold widely in Australia since it went on the market two and a half years ago, and is now being air-freighted out of the country as fast as the Adelaide-based manufacturers can make it.

The company involved is Welding Industries of Australia, a subsiduary of Siddons Industries Ltd. The product has been responsible for all most all of WIA's sales growth over the past couple of years.

No barrier to sales has been experienced so far. Last month, WIA

achieved an export rate of 100 units a month, and expect this rate to rise even further as the product gains acceptance on the huge north American market.

By any standards, what we have here is a success story in marketing. And this success, from CSIRO's point of view, has been largely due to the fact that from the very beginning of the research project, our scientists were very much in tune with the marketing strategies of the company.

This underscores a major point that I wish to make tonight, and that is that one of the most important factors in identifying and exploiting market opportunities for high-technology products is a high level of communication between marketing experts and scientific experts.

The product and its advantages

I intend to go into this aspect in more detail, but first, a few words about the product. Its name is 'The Synchro-Pulse CDT Welder' and here is a picture of it. It is an entirely new kind of welding machine, with significant advantages over conventional machines.

The initials 'CDT' stand for 'controlled drop transfer', an CSIRO-developed method of transferring welds to metal one drop at a time through an electric arc.

The CDT technology arose out of some quite fundamental research on the physical properties and behaviour of electric arcs. This the kind of 'ivory tower' research that universities, and to a lesser extent CSIRO, are sometimes criticised for doing by those who do not realise the commercial potential of such work.

The research involved using high speed movie cameras -- cameras that run through hundreds of feet of film in a matter of one or two seconds -- to 'slow down' what happens inside electric arcs. Once the scientists gained a basic understanding of what was happening inside the arc, they were able to work out more efficient ways of controlling it.

The advantages of the Synchro-Pulse welder are:

* FIRST, it is much simpler to operate than conventional machines -- it does away with most of the complicated adjustments that are usually necessary.

* SECOND, it is much cleaner -- it gives a very precise weld with none of the 'spatter' that you normally see, and that means that costly machining to 'clean up' welds is eliminated. As you can imagine with high-volme

production, that results in very large savings.

* THIRD, because it operates at lower temperatures, it does not have the same tendency to distort materials as normal machines. This is a particular advantage with very thin metal sheet, especially materials such as aluminium and stainless steel.

* FOURTH, it can operate from any angle of use, which means it can be used in 'tight corners' where normal machines cannot.

* FIFTH, it is especially well suited to computer-controlled robotic welding plants, which as you know is a very rapidly-growing market.

Because of these special advantages, ten Synchro-Pulse Welders were recently air-freighted to the North Sea oil fields to perform a difficult welding task on oil platforms, and they saved millions of pounds in barge fees because they did the job in a fraction of the expected time.

So you get the message: the Synchro-Pulse Welder is a high-quality product with great market appeal.

Close collaboration a factor in success

As I said before, a major reason for its success has been the very close collaboration that took place between CSIRO and WIA, and the fact that the scientists responsible for the research were at all times aware of market considerations.

I would like to quote to you from a recent public statement by Dr Graeme Ogilvie, Assistant Chief of the CSIRO Division of Manufacturing Technology and the scientist who conceived and led the development of the Synchro-Pulse Welder.

> 'Our experience with the Synchro-Pulse Welder,' said Dr Ogilvie, 'has driven home the very important lesson that the process of innovation is not linear -- that is, it doesn't lead from conception to invention to production to marketing in separate and isolated stages.
>
> 'Instead, it is esential that there be feedback up and down the chain at all times. Experience in marketing can feed back to production, or can feed directly back to research, even leading to revision of some quite basic ideas.
>
> 'The idea of a laboratory single handedly producing a package which can be then passed on to manufacturing

> industry to do what they like with is just not on. The special skills of industry in manufacuring and marketing must be combined with the special skills of the research team'.

Scientific research and market research must be carried out in tandem, so that scientists and marketing experts are continuously learning from each other as the product moves closer to the market place.

The Multiplier Effect

Before moving on to discuss the market research activities surrounding the welder, I would like to mention the 'multiplier effect' that comes into play when a successful innovation like this takes place.

The most obvious multiplier effect of the welder is that its influence is being felt in many areas of the metal fabrication industry in Australia, improving the efficiency and competitiveness of many of our products.

Just one example is a company that manufactures pre-fabricated communication antennas. This company is now including the Synchro-Pulse welder as part of its package, because the welder gives a neat weld bead which means that the parabolic receiving dish needs no machining after it has been welded together.

Of course, now that the Synchro-Pulse welder is being exported, other countries will have access to the same advantages -- but the fact is that for two years sales were limited to the domestic market and Australian companies had the chance to be 'first cab off the rank' with this new technology.

Another 'spin-off' has come for WIA itself, because the company will soon be able to market a range of welding wires -- the so-called 'welding consumables' -- that are especially suited to the Synchro-Pulse machine.

WIA has been marketing welding wires for many years, but it has done so using imported technology. It has had a licencing agreement with an overseas company which has unfortunately restricted its sales because, under the terms of the agreement, WIA has been able to sell its range of wires only on the Australian market.

A few years ago, WIA decided that it would try to develop some 'home grown' technology with the aim of eventually being able to enter the highly competitive but large world market for welding wires. It entered a collaborative agreement with CSIRO and has invested a great deal of time and money in welding wires

research.

The result has been the development of an expertise in welding consumables that simply didn't exist in Australia before -- and, more importantly, a completely new wire production facility that will turn out a new range of wires easily capable of competing on the world market. This capability, combined with the company's unique expertise in pulse welding, means that they will in due course be able to market wires particularly suited to use with the Synchro-Pulse welder.

This is exactly the kind of market niche that Australian manufacturing needs if it is to compete on export markets.

In addition, the research on pulse welding has paid off in another, quite unexpected way. You may be aware that Dunlop in Australia recently opened a new plant in Geelong to produce its new 'Pulsar' car battery, which has significant advantages over conventional car batteries and is to be exported in large numbers to the US.

Dunlop itself developed the technology for the Pulsar battery, but it came to CSIRO to obtain test measurements vital to the battery's acceptance on the north American market. Dunlop needed proof that its new battery would be able to start car engines reliably at temperatures as low as minus 18 degrees centigrade.

CSIRO was able to combine some of the switching technologies used in the Synchro-Pulse welder with the data acquisition system used for electric arc studies to conduct the relevant tests, known as 'transient response' measurements.

An interesting point here is that there was no other Australian laboratory capable of conducting these tests and there are no published accounts of similar measurements anywhere overseas.

The relationship between Dunlop and CSIRO has been a mutually beneficial one which has since led to the development of three different kinds of battery testers, which will be marketed by KTV Electronics and Powerplus Batteries for testing batteries during manufacturer, wholesale distribution and retail distribution.

To summarise, the spin-offs from the Synchro-Pulse welder have been that not only do we have a welder which is selling extremely well on overseas markets, we have:

* BETTER performance from our metal fabrication industry;

* AN EXCLUSIVE world market for welding wires suited to the Synchro Pulse machine:

* TEST INFORMATION that has aided export of a new kind of battery:

* and THREE NEW BATTERY TESTERS thrown in for good measure.

CSIRO achievements: a general picture

I have concentrated my remarks tonight on the example of the Synchro-Pulse welder, because it provides an excellent example of the way CSIRO does business.

I will be returning to this example, but, in case I am giving you the impression that it is the only product on our books, I would like to digress for a while and point out that it is only merely one of the projects developed by our Division of Manufacturing Technology, which is a relative newcomer, having been formed only six years ago. CSIRO has a total of 41 Divisions, all of which have been making similar contributions in their special fields.

Another major contribution in manufacturing includes the formation between ICI Australia Ltd and CSIRO through its commercial agent, Sirotech Ltd, of a joint company, Z-Tech Pty Ltd, to penetrate major overseas markets for high-technology ceramic materials.

Z-Tech is expected to supply zirconia, the raw material for a new, extremely strong ceramic called 'Patrially Stabilized Zirconia', or 'PSZ', invented by CSIRO's Division of Materials Science. PSZ is being developed and marketed by the Australian company, Nilcra Ceramics Pty Ltd. The market for new industrial ceramics is expanding rapidly, and Nilcra recently won what is believed to the biggest contract yet placed for PSZ, beating US and Japanese competitors.

Briefly, in manufacturing I could also list:

* The high-speed vision processor, a huge advance in the field of robotic vision, soon to he exported by the Adelaide-based company Vision Systems Ltd for incorporation in complete robot systems by overseas manufacturers:

* Metlflow, a software system now being exported by the Melbourne-based company Moldflow Pty Ltd to overseas car manufacturing giants such as General Motors in Detroit:

* Liteslice, a unit capable of checking the condition of railway lines at high speed, now being exported at half a million dollars per unit by the Perth-based company Aldetec Pty Ltd:

* Scrimber, a process which makes strong, structural quality timber out of small-diameter logs, using some 85 per cent of the long compared with about 40 per cent in current sawmilling techniques:

* and Coalscan, a world-beating method of measuring the ash content of coal, which has already resulted in sales of $3.25 million for its Adelaide-based manufacturers, Mineral Control Instrumentation.

I could list many more examples in manufacturing, from a compact electron multiplier in demand world-wide by makers of laboratory machinery to a new, low-cost source of X-rays, a new design for electrically-driven car radiator fans and a fast-curing industrial paint.

Not to mention the Organization's contributions in rural industry, such as the recent $1.8 million agreement to develop transposable DNA elements in crops, and the breeding of a new line of linseed that can be used for edible products, to name but two out of hundreds.

And not to mention, either, our contributions to the minerals and energy industries, such as Sirosmelt, a new smelting technology that will cut energy costs, and new thermal satellite imaging techniques to aid exploration -- nor our contributions to the information and services industries, such as the special-purpose microchips, and building and housing codes.

CSIRO, you can see, has been of major benefit to a very wide range of industries in Australia, and collaborates very closely with them. Those companies who have collaborated with CSIRO know to their own advantage that CSIRO can provide exactly the kind of technology transfer that is needed if Australian companies are to compete on world markets.

Identification of the market opportunity

To return to the subject, the identification and researching of market opportunities, I would like now to go back to our example of the Synchro-Pulse welder and examine, first of all, how it was identified.

As I understand it, the identification of this product goes back to a technical conference held in Brisbane nearly six years ago. At this, a research paper was presented by a CSIRO scientist and another research paper was presented by a group of research and development people from WIA.

WIA had already had limited success in marketing an early form of

a pulse welder, and, after attending the conference, they realised that CSIRO's Division of Manufacturing Technology was able and willing to help them in developing an improved product.

Collaborative work started, and as the two partners progressed together, they realised that a major breakthrough in controlling the height and width of the mains pulse was needed.

After making several calls on expertise in other CSIRO Divisions -- and taken together these Divisions represent a rich resource of talent and equipment which no single Australian company could hope to duplicate on its own -- the collaborative group eventually achieved the breakthrough for which they were looking.

The important point here is that the precondition necessary to identify a high-technology opportunity was interaction between CSIRO and industry. The fact that this took place at a conference is incidental: whether contacts are made at conferences, or through CSIRO performing, where possible, a limited amount of 'troubleshooting' work with industry, or formally through CSIRO's commercial agent Sirotech Ltd, or through informal links, does not matter so much -- as long as there is a strong and continuing level of interaction.

'Market Research': a primary responsibility of the company

Most of the 'market research' conducted for this product was performed by Welding Industries of Australia during the normal course of its business.

It is not as if WIA was launching off into some entirely new product area. In fact, they had been involved in the marketing of a range of welding machinery for many years, and, naturally, they had been continuously surveying their market.

On the basis of their detailed knowldge of the market, they were aware of the benefits that would flow from an improved product. In the words of WIA's Marketing Manager, Mr Sid Ellsworthy:

> 'As the research advanced we asked ourselves "Where are the biggest benefits of this machine going to be?" The answer was fairly plain -- the greatest benefits would be in those industries such as aluminium boat building, truck-building and of course stainless steel fabrication where distortion of thin sheet was a problem. It was also apparent to us that there were many potential customers in the more conventional area of ferrous welding.'

The company's market predictions were pretty close. They predicted about 80 per cent of the customers who bought machines over the first two years -- and the remaining 20 per cent who

they didn't predict have turned out to be an unexpected bonus.

When the company was preparing to venture into the export market in the United States, they first surveyed the market carefully to reassure themselves that their product would be competitive. They next undertook a survey to find the right companies to distribute, market and service their product.

Since exports started to the US a short while ago, they have already discovered markets that they never see in Australia, such as aircraft manufacturing, which could be very big indeed.

Recently, WIA sent a representative to the Atlanta Welding Show to take advantage of the opportunity provided by the Show to gather market information. Both the UK and the US are now taking pulse welding very seriously indeed, and a special meeting was held to evaluate products currently on the market. The results of that meeting showed that the Australian product is quite a bit ahead of its nearest competitor.

WIA is aware of the fact that, having become a market leader, it is susceptible to other companies copying their technology. At this stage they estimate they have about 9-12 months before the US competition catches up, by which time they hope to have further improvements to their product in place.

To move from this specific example to a generalisation: the experience with this welder is typical of most of CSIRO's high-technology work -- CSIRO sees its collaborative partners in industry as having the major responsibility for market research on the products.

To put this in its very simplest form, we say to companies when we draw up collaborative agreements: 'You supply the manufacturing and marketing expetise, and we will supply the scientific expertise'.

To quote again from Dr Ogilvie:

> 'A very important reason for seeking collaboration at an early stage is to validate the way we are going. As researchers, we are prepared to explore on our own initiative for a while, but when we reach the stage where a big investment of time and money is required, we seek validation of the activity by advertising for a commercial partner.'

This is, if you like, a 'natural selection' or 'free market' method of ensuring that CSIRO's work is commercially-oriented. If no suitable commercial partner can be found, the research is shelved at an early stage and other, more promising, leads are

pursued.

As for selecting the direction our research will take at the very beginning of the research process, a commonly used method is to interact closely with industry associations, such as the Metal Trades Industry Association or the many mining and agricultural bodies.

CSIRO asks these associations to nominate areas of common interest, where its research will be of benefit, if possible, to a number of companies rather than just one. Again, the major responsibility for market research here rests with the industries -- they are the ones who should know where the greatest market opportunities exist.

Sirotech Ltd -- CSIRO's commercial agent

A high degree of marketing expertise is one of the most important factors CSIRO looks for in its selection of commercial partners. The Organisation looks for the company that has 'done its homework' and has the most detailed market knowledge.

But how can a group of scientists really evaluate the marketing ability of one company against another?

This is where Sirotech comes in. Sirotech Ltd is CSIRO's commercial agent, established in 1984 to give the Organization the services of a thoroughly commercial company run by business people.

The Chairman of Sirotech is Mr Lindsay Cuming, former Chief Executive of Nicholas-Kiwi, and the Managing Director is Mr Julian Doyle, a lawyer with wide international trade and commercial expertise.

Sirotech is in the business of transferrng scientific research results with sound commercial potential to the industry, and I quote here from Mr Doyle 'capable of making the best use of those results to maximise the ultimate benefit to Australia'.

'Our task,' says Mr Doyle, 'is also to advise CSIRO on complex commercial documents and to vet licensing and industrial property agreements. We are able to provide commercial advice on new business ventures, and we play an important role in identifying both industry's and CSIRO's needs, enabling each to understand the other's perspective.

'The achievement of our goals' -- and I am still quoting here from the Managing Director, 'depends on a number of management factors -- good communications, patent management, financial and legal expertise, and above all, first class marketing.'

Sirotech can provide answers to some of the most crucial questions in transferring a new high-technology product: Can the product be identified and protected? Does it work? Who knows about it? And last, but by no means least, who wants to buy it?

To conclude: CSIRO is in fact more than just a scientific organisation when it comes to selecting the best commercial partners with the best expertise in marketing and market research.

The commercial approach taken by our scientists is illustrated by quoting from a lecture given by the Chief of our Division of Manufacturing Technology, Dr Bob Brown.

> 'Specific goals which must be aimed for in any manufacture, said Dr Brown, 'are markets, costs and quality. These are obvious. Without a market, there is no point in manufacture. Cost must be right to suit the selling price in the specific market ... and quality has to be built-in to the product, or market acceptance will be lost'.

In CSIRO, we have scientists who are 'switched on' to marketing considerations and willing to collaborate with industrial partners for commercial benefits.

But scientific research and market research must be carried out in tandem. This is crucial if we are to have the technology transfer which will enable Australia to compete on world markets and thereby ensure a sound economic future for our country.